REMARKS

Claims 2-4 are pending herein. By the Office Action, claims 2-4 are rejected under 35 U.S.C. §103(a). By this Amendment, claim 2 is amended. Support for amended claim 2 can be found in the specification as filed, for example at page 27, lines 5-9 and page 31, lines 28-32. No new matter is added.

I. Rejection Under 35 U.S.C. §103

The Office Action rejects claims 2-4 under 35 U.S.C. §103(a) over Dou in view of Hirota. The Office Action argues that Dou discloses all of the elements of the claimed invention, except the limitation that the particulate filter and the NO_x absorber can be combined into one single housing, but that such a teaching is provided by Hirota. Applicants respectfully traverse this rejection with respect to pending amended claims 2-4.

The Office Action asserts that Dou discloses all of the features of the claimed invention except the limitation that the particulate filter and the NO_x absorber can be combined into one single housing. The Office Action argues, however, that a combined NO_x absorbent and particulate filter is conventional, as shown in Hirota. Applicants respectfully disagree.

A. The Claimed Invention

According to the claimed invention, a catalyst apparatus for purifying NO_x is located in the exhaust system upstream of the particulate filter. See claim 2. The catalyst apparatus can thus carry a large amount of catalyst absorbing NO_x to sufficiently absorb NO_x in the exhaust gas. When the air-fuel ratio in the catalyst apparatus is made stochiometric or rich, the absorbed NOx is released and can be purified by reduction. As a result, according to the claimed invention, the devices can sufficiently purify NO_x in the exhaust gas. Such devices are not disclosed in and would not have been obvious over a combination of Dou and Hirota.

A device for purifying the exhaust gas of an internal combustion engine according to the claimed invention, comprises a particulate filter arranged in the exhaust system, a

catalytic apparatus for purifying NO_x when the air-fuel ratio in the surrounding atmosphere thereof is lean and releasing the absorbed NO_x when said air-fuel ratio is stoichiometric or rich, bypassing means to make possible the exhaust gas bypass said particulate filter downstream said catalytic apparatus, and control means for making the air-fuel ratio in said catalytic apparatus rich to release NO_x from said catalyst of said catalytic apparatus to purify the released NO_x by reduction, and making the air-fuel ratio in the particulate filter rich to release NO_x from said catalyst of said particulate filter to purify the released NO_x by reduction so that said catalyst of said particulate filter also releases active-oxygen to oxidize and remove the particulates trapped on said particulate filter without producing luminous flame without further elevating the temperature of the trapped particulates to ignite and burn the trapped particulates.

The particulate filter carries a catalyst for absorbing and reducing NO_x. This material is located on the exhaust gas upstream side surface thereof, and thus an active-oxygen is released from the partition wall. Therefore, the particulates trapped on the partition wall can automatically be oxidized and removed by an active-oxygen released therefrom.

According to the claimed invention, such a catalyst apparatus is arranged upstream of the particulate filter. Therefore, NO_x in the exhaust gas can be sufficiently purified. Additionally, when the control means makes the air-fuel ratio in the catalytic apparatus rich to release NO_x from the catalyst of the catalytic apparatus to purify the released NO_x by reduction, the catalyst of the catalytic apparatus also releases an active-oxygen similarly with the catalyst carried on the particulate filter, and thus the active oxygen enters into the particulate filter arranged downstream of the catalytic apparatus, and oxidizes the particulates trapped thereon without producing luminous flame. Therefore, the particulates trapped on the particulate filter can be easily oxidized and removed by the active-oxygen released from the particulate filter and by an active-oxygen released from the catalytic apparatus when the air-fuel ratio is made rich.

Such devices for purifying the exhaust gas of an internal combustion engine, as claimed, are nowhere taught or suggested by the cited references.

B. The References Do Not Teach or Suggest the Claimed Control Means

According to claim 2, the claimed device specifically includes a control means for making the air-fuel ratio in said catalytic apparatus rich to release NO_x from said catalyst of said catalytic apparatus to purify the released NO_x by reduction, and making the air-fuel ratio in the particulate filter rich to release NO_x from said catalyst of said particulate filter to purify the released NO_x by reduction so that said catalyst of said particulate filter also releases active-oxygen to oxidize and remove the particulates trapped on said particulate filter without producing luminous flame without further elevating the temperature of the trapped particulates to ignite and burn the trapped particulates. Such a control means is nowhere taught or suggested by the cited references.

According to the device for purifying the exhaust gas of an internal combustion engine described in claim 2, NOx in the exhaust gas can be sufficiently purified by the particulate filter and the catalytic apparatus that carries the catalyst absorbing NOx. Additionally, when the control means makes the air-fuel ratio in the catalytic apparatus rich to release NOx from the catalyst of the catalytic apparatus to purify the released NOx by reduction, the catalyst of the catalytic apparatus also releases active oxygen. As a result, the active oxygen enters into the particulate filter arranged downstream of the catalytic apparatus, and oxidizes the particulates trapped therein without producing luminous flame. Moreover, when the claimed control means makes the air-fuel ratio in the particulate filter rich to release NOx from the catalyst of the particulate filter to purify the released NOx by reduction, the catalyst of the particulate filter also releases active oxygen. As a result, the active oxygen oxidizes and removes the particulates trapped on the particulate filter without producing luminous flame.

The oxidation and removal of particulates trapped on the particulate filter is carried out at a relatively low temperature and is different from burning of the particulate with the production of luminous flame after the temperature of the trapped particulates is elevated to their ignition temperature. Thus, in the oxidation of the particulates in the claimed device, after the air-fuel ratio in the particulate filter is made rich to release NOx and the released NOx is purified, it is not required for the temperature of the trapped particulates to be elevated to their ignition temperature.

In contrast to the claimed invention, Hirota teaches that when the air-fuel ratio is made rich to release NOx from the catalyst of the particulate filter and to purify the released NOx by reduction, the heating in the NOx releasing and reduction elevates the temperature of the trapped particulates so that the energy to ignite and burn the trapped particulates can be reduced. In particular, Hirota teaches that the trapped particulates must be burned with producing luminous flame, in order to be removed from the particulate filter. Thus, as described in Hirota at paragraph [0021], after the trapped particulates are heated by heat generated in the NOx releasing and reduction, the temperature of the trapped particulates is further elevated to their ignition temperature by a fuel supply or an electric heater.

Hirota does not teach or suggest that when the air-fuel ratio in the particulate filter is made rich, the catalyst absorbing NOx carried on the particulate filter releases an active oxygen. Thereafter, if the air-fuel ratio in the particulate filter is made rich to release NOx and purify the released NOx, the trapped particulates are oxidized and removed for a few minutes by the released active oxygen. Nevertheless, in the device of Hirota, after the air-fuel ratio is made rich, the temperature of the trapped particulates is further elevated to their ignition temperature by a fuel supply and an electric heater.

In contrast, the claimed invention does not use a fuel supply and an electric heater to further elevate the temperature of the trapped particulates to their ignition temperature. Instead, the trapped particulates in the claimed device are oxidized and removed without

producing luminous flame without further elevating the temperature of the trapped particulates to ignite and burn the trapped particulates.

Accordingly, it would not have been obvious to replace the downstream side catalytic apparatus of Dou with the particulate filter of Hirota, and to further modify the resultant combination to practice the claimed invention. Such a combination would still not include the control means of the claimed invention.

C. The Cited References Do Not Teach or Suggest the Claimed Invention

Dou does not teach or suggest a particulate filter or a catalytic apparatus for purifying NO_x, as claimed. Rather, Dou discloses a method for providing a sulfur scavenger and a downstream NO_x absorber catalyst within an exhaust stream. The sulfur scavenger preferably uses trapping metals such as silver, aluminum, barium, cerium, cobalt, copper, lanthanum, lithium, magnesium, sodium, neodymium, rubidium, tin, strontium and zinc. See paragraph [0036] of Dou. In contrast, the claimed invention requires a catalytic apparatus that employs a process of purifying nitrous oxides NO_x. As is well known in the art, such sulfur scavenger of Dou and NO_x purifiers of the claimed invention are distinctly different. The catalytic apparatus of the claimed invention uses an alkali metal (*e.g.*, potassium) or alkali earth metal having stronger ionization than calcium Ca (within the exhaust). In the claimed invention, the potassium (or other component) bonds with sulfur trioxide SO_3 to form potassium sulfate K_2SO_4. This product passes the partition walls of the particulate filter rather than forming an ash of calcium sulfate $CaSO_4$ that could block the particulate filter. See specification at page 41, lines 6-23.

Thus, Dou teaches away from the present invention. Dou teaches an apparatus that traps sulfur, rather than an apparatus that purifies NO_x and in the process allows sulfur to pass through the particulate filter.

Further, Dou does not mention a particulate filter, despite identification as such in the Office Action of undescribed item 6 in Fig. 15 of Dou. Hence, there is no motivation to

combine a non-included particulate filter with a catalyst for absorbing and reducing NO_x. Additionally, there is no motivation or suggestion in Dou to modify (in fact destroy) its disclosed sulfur scavenger to reach the features of the claimed invention.

Hirota does not overcome the deficiencies of Dou. Hirota is cited for the asserted disclosure that it is conventional in the art to use a catalyzed particulate filter that carries an NO_X absorber. However, regardless of such a disclosure, any combination of Dou and Hirota would not have resulted in the claimed invention.

First, as described above, Dou discloses a sulfur scavenger. Any combination of Dou and Hirota would still include this sulfur scavenger, as neither reference teaches or suggests any reason to remove the inventive sulfur scavenger of Dou in favor of an NO_x purifier as claimed.

Second, as also described above, Dou discloses a downstream NO_x absorber catalyst within an exhaust stream. Any combination of Dou and Hirota would likewise still include this downstream NO_x absorber catalyst, as neither reference teaches or suggests any reason to move the NO_x absorber catalyst from a downstream position to an upstream position, as claimed.

Accordingly, one of ordinary skill in the art would not have been motivated, based on the cited references, to practice the claimed invention. The claimed invention of claims 2-4 thus would not have been obvious over the cited references. Reconsideration and withdrawal of the rejection is respectfully requested.

D. Applicants' Arguments Were Considered and Agreed to by the Examiner

Furthermore, Applicants submit that the above arguments have already been presented to the Examiner, and found persuasive. Similar arguments were previously made in response to a rejection over Dou and Maaseidvaag. See, for example, the Amendments filed April 30 and September 4, 2002. The arguments were also presented in detail in an Examiner Interview, in which the Examiner agreed that "Applicant's argument that the prior

art of record fail to show an upstream catalytic converter that carries the same catalyst as the downstream filter for absorbing and reducing NOx is persuasive." See Interview Summary dated August 5, 2002.

For essentially the same reasons that Dou and Maaseidvaag were found not to disclose or suggest the invention of then independent claim 1 and its dependent claims, instant claims 2-4 would not have been rendered obvious by a combination of Dou and Hirota.

II. Conclusion

For at least the reasons set forth above, Applicants respectfully submit that the application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Joel S. Armstrong
Registration No. 36,430

JAO:JSA

Date: October 11, 2005

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461